Osteological Analysis

Main Street

Torksey

Lincolnshire

Site Code: TOMS03
NGR: SK 8377 7890

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Summary

York Osteoarchaeology Ltd was commissioned by Lindsey Archaeological Services to carry out the osteological analysis of eight skeletons, and four disarticulated human bone assemblages. The skeletal remains were recovered during an archaeological watching brief in autumn 2003 at the Main Street, Torksey, Lincolnshire (NGR SK 8377 7890) in advance of a housing development.

Archaeological evaluations of the area in 2001 and 2002 located twelve skeletons, seven of which were excavated and one of these was a double burial of a child and an adult. It is thought that the skeletons and high status buildings relate to the Augustinian Priory of St Leonard's and the three impropriated parish churches in Torksey. This group of skeletons was previously analysed and included three males and a female, all of whom were young to middle-aged adults. Additionally, three children and a young infant were found (Booth 2002).

The skeletons excavated in 2003 were interred in oval or rectangular graves in supine, extended positions. They were buried in the typical Christian manner, with the heads to the west and the feet to the east. Two of the skeletons had been interred in stone cists. Notably, five of the seven burials excavated in 2001 were also buried in stone cists. All of the burials are thought to date to the medieval period, although they may be pre-Conquest.

Osteological analysis revealed that the skeletons represented a mixed group, including all ages and both sexes. Five of the skeletons were male, while two were female. The adults were all older than 46 years, with the exception of two middle-aged males. The only child was between seven and eight years old.

Evidence for disease was minimal in the child, who had suffered from a congenital anomaly. However, the evidence suggests that the whole population experienced periods of physical stress during childhood in the form of malnutrition or disease. Those who survived these episodes into adulthood exhibited degenerative lesions, tumours and other conditions that were age-related. They also showed evidence for activity-related trauma, including muscular strain and fractures, although the latter may have been the result of inter-personal violence. It is also possible that several cases of inflammation and osteoarthritis were work-related, or may have been secondary to trauma.

Acknowledgements

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1.0 INTRODUCTION

In May 2005 York Osteoarchaeology Ltd was commissioned by Lindsey Archaeological Services to carry out the osteological analysis of eight skeletons, and four disarticulated human bone assemblages. The skeletal remains had been excavated in autumn 2003 during an archaeological watching brief at the Main Street, Torksey, Lincolnshire (NGR SK 8377 7890).

The site is located opposite a parish church and is thought to be within the area occupied by the Augustinian Priory of St Leonard's. All the burials recovered are believed to date to the medieval period, although it is not clear, whether they date to the pre-Conquest or later medieval period. Earlier work at the site had revealed twelve further burials, seven of which were recovered, five of which were interred in cists.

Two of the recently excavated skeletons were also buried in walled cists. The skeletons were buried in single graves in supine and extended positions (Table 1). All the skeletons lay with their heads to the west and their feet to the east, in a typical Christian manner.

Table 1 Summary of archaeological information of complete skeletons

Skeleton No	Feature	Context	Position	Orientation	Cist
1	1009	1010	Supine extended	West to east	-
2	1016	1018	Supine extended	West to east	-
3	1012	1027	Supine extended	West to east	-
4	1031	1032	Supine extended	West to east	-
5	1107	1108	Supine extended	West to east	-
6	1210	1212	Supine extended	West to east	Walled cist
7	1222	1224	Supine extended	West to east	Walled cist
8	1228	1229	Supine extended	West to east	-

A number of animal bone fragments were found amongst the skeletal remains (with Skeletons 2 and 8) and are thought to have been residual.

Disarticulated bone was recovered from four different features or layers thought to date from the medieval and early post-medieval periods (Appendix A).

1.1 AIMS AND OBJECTIVES

The aim of the skeletal analysis was to determine the age, sex and stature of the skeletons, as well as to record and diagnose any skeletal manifestations of disease and trauma. It was aimed to calculate the minimum number of individuals buried at the site from the skeletons and disarticulated remains.

1.2 METHODOLOGY

The skeletons and disarticulated remains were analysed in detail, assessing the preservation and completeness, calculating the minimum number of individuals present as well as determining the age, sex and stature of the individuals (Appendix A). All pathological lesions were recorded and described.

2.0 OSTEOLOGICAL ANALYSIS

Osteological analysis is concerned with the determination of the identity of a skeleton, by estimating its age, sex and stature. Robusticity and non-metric traits can provide further information on the appearance and familial affinities of the individual studied. This information is essential in order to determine the prevalence of disease types and age-related changes. It is crucial for identifying gender dimorphism in occupation, lifestyle and diet, as well as the role of different age groups in society.

2.1 PRESERVATION

Skeletal preservation depends upon a number of factors, including the age and sex of the individual as well as the size, shape and robusticity of the bone. Burial environment, post-depositional disturbance and treatment following excavation can also have a considerable impact on bone condition. Preservation of human skeletal remains is assessed subjectively, depending upon the severity of bone surface erosion and post-mortem breaks, but disregarding completeness.

Preservation was assessed using a grading system of five categories: very poor, poor, moderate, good and excellent. Excellent preservation implied no bone surface erosion and very few or no breaks, whereas very poor preservation indicated complete or almost complete loss of the bone surface due to erosion and severe fragmentation.

Four of the skeletons (50%) were in excellent condition (Table 2). They had not suffered from post-mortem breaks or surface erosion. Two skeletons (25%) were well-preserved, with little surface erosion or bone fragmentation. A further two skeletons were in a moderate condition; they exhibited moderate erosion and fragmentation. The cause for the moderate preservation was damage by a mechanical excavating machine in both cases.

Table 2 Summary of osteological and palaeopathological results

Skeleton No	**Preservation**	**Completeness**	**Age in Years**	**Sex**	**Stature**	**Pathology**
1	Excellent	92%	7-8	-	-	Bifid 5th lumbar vertebra, bone excavations
2	Excellent	98%	26-35	Male	168.4 ± 2.99cm	Bifid S1, *cribra orbitalia*, periostitis of tibiae, osteochondrosis, 9 rib fractures, *os acromiale*, haematomas of tibiae, osteochondritis dissecans, *enthesopathies*, bone excavations
3	Excellent	99%	46+	Female	170.5 ± 3.55cm	DJD in spine, hips, shoulders, right wrist, right knee, Schmorl's nodes, osteoarthritis in wrist, bone excavations
4	Good	96%	46+	Female	167.7 ± 3.55cm	Congenital anomalies of 1st rib, manubrium, sternum, sinusitis DJD in spine, pelvis, right knee, left scapula, osteoporosis, arachnoid granulations, *enthesopathies*, bone excavations

5	Excellent	97%	26-35	Male	174. 3± 3.27cm	Periostitis of tibiae and right fibula, sinusitis, Schmorl's nodes, fractured right fibula, bone excavations
6	Good	92%	46+	Male	170.9 ± 2.99cm	Periostitis of right tibia, left ulna, right radius, DJD in spine, shoulders, hips, right knee, osteoporosis, vertebral fracture, button osteoma, Paget's disease, *enthesopathies*, bone excavations
7	Moderate	85%	46+	Male	175.1 ± 2.99cm	Six lumbar vertebrae, periostitis in tibiae and left fibula, DJD in right wrist, spine, hips, shoulders, right elbow, osteoarthritis in wrists, right hand, left elbow, spine, osteoporosis, blunt force cranial trauma, 2 rib fractures, arachnoid granulations, *enthesopathies*, bone excavations
8	Moderate	60%	46+	Male	169.4 ± 2.99cm	periostitis of tibiae, *cribra orbitalia*, DJD in spine, bone excavations

The completeness of the skeletons also varied. The majority of skeletons were 90% or more complete (see Table 2). In the two moderately well-preserved skeletons, some bone had been lost through damage by a mechanical digger. In fact, Skeleton 8 was not archaeologically excavated and all the bone recovered (60% of the skeleton) had been retrieved from the spoil heap.

The disarticulated remains were generally well-preserved. The assemblage consisted of foot bones, vertebrae, a mandible and a shoulder blade (Appendix A).

2.2 MINIMUM NUMBER OF INDIVIDUALS

A count of the 'minimum number of individuals' (MNI) recovered from a cemetery is carried out as standard procedure in osteological reports on inhumations in order to establish how many individuals are represented by the articulated and disarticulated human bones (without taking the archaeologically defined graves into account). The MNI is calculated by counting all long bone ends, as well as other larger skeletal elements recovered. The largest number of these is then taken as the MNI. The MNI is likely to be lower than the actual number of skeletons which would have been interred on the site, but represents the minimum number of individuals which can be scientifically proven to be present.

Using the inhumation burials and disarticulated bone to calculate the MNI, it was found that at least nine individuals were represented. A MNI of five adult males, two adult females, one adult of unknown sex and one juvenile were present at the site. The bone most commonly found was the left shoulder joint (glenoid cavity).

2.3 ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000). Age estimation relies on the presence of the pelvis and uses different stages of bone development and degeneration in order to calculate the age of an individual. Age is split into a number of categories, from foetus (up to 40 weeks in *utero*), neonate (around the time of birth), infant (newborn to one year), juvenile (1-12 years), adolescent (13-17 years), young adult (ya; 18-25 years), young middle adult (yma; 26-35 years), old middle adult (oma; 36-45 years), mature adult (ma; 46+) to adult (an individual whose age could not be determined more accurately as over the age of seventeen).

Age estimation of the adult skeletons was based on as many criteria as possible. These suggested that three of the males and both females were mature adults, aged 46 years or older (Skeletons 3, 4, 6, 7 and 8), although Skeletons 4, 6 and 7 were probably much older, around 60 years old. The remaining two males were aged between 26 and 35 years (Skeletons 2 and 5).

Dental development, bone fusion and long bone length suggested that Skeleton 1 was a juvenile, aged between seven and eight years. The dental age of this child implied a slightly older age than the long bone length and bone fusion, suggesting that the child might have suffered delayed growth as a result of disease or malnutrition.

It was not possible to establish age in the majority of disarticulated bone fragments. However, in one case it was possible to determine age, namely in a mandible belonging to a male adult, who was at least 36 years old (1314). Dental wear suggested a younger age compared with bone degeneration in the complete skeletons, suggesting that this group ate a soft diet and suggests that this mandible may have belonged to someone who was aged 46 years or older.

2.4 SEX DETERMINATION

Sex determination was carried out using standard osteological techniques, such as those described by Mays and Cox (2000). Assessment of sex in both males and females relies on the preservation of the skull and the pelvis and can only be carried out once sexual characteristics have developed, during late puberty and early adulthood.

On the basis of the hip and skull characteristics, Skeletons 2, 5, 6 and 8 were male and Skeleton 4 was a female (see Table 2). Sex determination was less conclusive in Skeletons 3 and 7, the former of which was thought to be a probable male on the basis of the cranial sexing characteristics, but female on the basis of the pelvis and measurements. However, the skull of mature women can sometimes take a male appearance and more emphasis was therefore placed on the pelvis than on the skull.

One of the sexing characteristics of the pelvis of Skeleton 7 suggested that this was a female, while the remainder of the skeletal characteristics and measurements indicated a male. It was therefore decided that this was a male skeleton. It was not possible to determine sex in juvenile Skeleton 1.

Sex could be established in one of disarticulated remains (Appendix A); this was a male mandible from C1314.

2.5 METRIC ANALYSIS

Stature depends on two main factors, heredity and environment. However, stature can also fluctuate between chronological periods. Stature can only be established in skeletons if at least one complete and fully fused long bone is present. The bone is measured on an osteometric board, and stature is then calculated using a regression formula developed upon individuals of known stature.

In this instance, it was possible to assess stature in all of the adult skeletons (see Table 2). The two women were between 167.7cm and 170.5cm tall (see Table 2), with a mean of 169.1cm. This was considerably taller than the medieval mean stature for females (158.6cm) calculated by Caffell (1997), but is within her medieval stature range, which runs from 143.8cm to 171.4cm.

The five males were between 168.4cm and 175.1cm tall (see Table 2), with a mean of 171.6cm. This was slightly taller than the stature calculated for medieval males (170.5cm) by Caffell (1997). While the male stature corresponds with that gained from other monastic sites, such as St Andrew's, Fishergate in York (Stroud and Kemp 1993), the female stature was considerably taller than that from other high status sites, with the exception of those from the Minster at St Oswald's in Gloucester (Rogers 1999).

Leg measurements were obtained from the adult femora and tibiae and used to calculate robusticity indices. The *platymeria* index is a method of calculating the shape and robusticity of the femoral shaft. The femora of Skeletons 2, 4, 5, 7 and 8 were *platymeric* (broad and flat), while the femora of Skeletons 3 and 6 were *eurymeric* (more rounded).

The *platycnemia* index of the tibiae was calculated in order to establish the degree of tibial shaft flatness. The tibial shafts of Skeletons 3, 4, 5, 6, 7 and 8 were *eurycnemic* (of average dimensions), while the left tibial shaft of Skeleton 2 was flatter (*platycnemic*).

Measurements of the arm bones could not detect any clear evidence for left or right-handedness, with the exception of male Skeletons 5 and 8, whose right arm bones were more strongly developed than those from the left side.

It was possible to calculate the cranial index of the adult skulls with the exception of Skeletons 4, 7 and 8; their skulls were too incomplete. Two of the skulls (Skeletons 2 and 6) were broad or round, which tends to be typical for the medieval period, one skull (Skeleton 5) was of average dimensions and the skull of female Skeleton 3 was long and narrow, which tends to be most typical for the Anglo-Saxon period.

2.6 NON-METRIC TRAITS

Non-metric traits are additional sutures, facets, bony processes, canals and foramina, which occur in a minority of skeletons and are believed to suggest hereditary affiliation between skeletons (Saunders 1989). The origins of non-metric traits have been extensively discussed in the osteological literature and it is now thought that while most non-metric traits have genetic origins, some can be produced by factors such as mechanical stress (Kennedy 1989) or environment (Trinkhaus 1978).

A total of thirty cranial (skull) and thirty post-cranial (bones of the body and limbs) non-metric traits were selected from the osteological literature (Buikstra and Ubelaker 1994, Finnegan 1978, Berry and Berry 1967) and recorded. The disarticulated bones were also scanned for non-metric traits.

The majority of non-metric traits were observed on the skull. These were anomalies that would not have affected the individual. Cranial traits are more likely to be genetic in origin than those noted on the remaining part of the skeleton, which can often be affected by mechanical stress.

Cranial non-metric traits observed in three or more skeletons included *mastoid foramen extrasutural* (Skeletons 2, 3 and 7). A further common trait was *ossicles in the lambdoid suture* (an additional bone in the suture at the back of the head) (Skeletons 2, 4, 5, 6 and 8). Incomplete *foramen ovale* (a divided hole at the base of the skull (Skeletons 2, 3, 4 and 6), *ossicles at asterion* (an additional bone in the suture behind the ear) (Skeletons 4, 5 and 8) and *maxillary tori* (bony lumps on the internal surface of the upper jaw) (Skeletons 2, 3 and 5) were also frequently observed. These minor anomalies were probably genetic in origin.

Common post-cranial traits included *acetabular notches* (a small depression in the hip joint) in Skeletons 3, 4, 7 and 8. *Poirier's facets* (extensions of the proximal femoral joint) were also noted in four skeletons (Skeletons 2, 4, 5 and 8). Additional facets on the ankle bones (*double inferior talar facets, double anterior calcaneal facets*) were widespread and were noted in Skeletons 2, 3, 5, 7 and 8.

Other post-cranial traits observed included *exostoses in trochanteric fossa* (bone projections at the femoral neck), indicative of mechanical stress on the *obturator externus* muscle, which laterally rotates the thigh and this trait may therefore by activity-related (Stone and Stone 1990, 159). This was noted in Skeletons 3, 6 and 8). Another activity-related non-metric trait was *hypotrochanteric fosse* (depressed areas at the back of the femora) at the attachments of the *gluteus maximus* bottom muscle of Skeleton 5. The depressed areas are thought to reflect strain on the muscle.

Non-metric traits were not observed in the disarticulated or cremated remains.

2.7 CONCLUSION

Osteological analysis of the skeletal remains established that this was a mixed cemetery, including individuals of all age groups and both sexes, although the majority of individuals were male and mature adults. The individuals from Torksey Main Street were well-built and tall. The presence of mutual non-metric traits may suggest that some of these individuals were blood-related.

When comparing the results of the osteological analysis of the recently excavated skeletons with those recovered and analysed in 2001, it is notable that the earlier group included more children (three juveniles and one infant) and only young or middle-aged adults (Table 3). However, the ratio of males to females was similar in both assemblages.

Table 3 Summary of results of skeletal analysis of skeletons excavated in 2001 (from Booth 2002)

Skeleton	Preservation	Age	Sex	Stature	Pathology
414	Good	5-7	-	-	-
436	Good	19-22	Male	163.9	Schmorl's nodes, Scheuermann's
466	Good	30-38	Female	156	DJD in spine, knees, left wrist, left foot, Schmorl's nodes
466	Good	3.5-4.5	-	-	-
469	Poor	20-25	Male	176	Schmorl's nodes, osteochondritis dissecans of the left foot phalanx
482	Poor	25-30	Male	168	Schmorl's nodes, porotic hyperostosis, osteochondritis

					dissecans of the right foot phalanx
486	Good	5-7	-	-	-
488	Good	6-9 months	-	-	-

The stature of the 2001 group was lower than that of the recently analysed skeletons, with the exception of a tall male (Skeleton 469). One non-metric trait common in the recently excavated assemblage was also widespread in the earlier group, namely double *anterior calcaneal facets*.

3.0 PATHOLOGICAL ANALYSIS

Pathological conditions (disease) can manifest themselves on the skeleton, especially when these are chronic conditions or the result of trauma to the bone. The bone elements to which muscles attach can also provide information on muscle trauma and excessive use of muscles.

3.1 CONGENITAL ANOMALIES

Heredity and environment can predispose an individual to congenital anomalies. Congenital malformations are commonly observed in archaeological populations. Most congenital conditions observed in skeletons are simple anomalies, which do not affect the person exhibiting the defect. One of these was noted in the fifth lumbar vertebra of the juvenile (Skeleton 1), characterised by partial separation of the spinous process of the vertebra. This anomaly would have had little effect on the individual. A similar defect was noted in Skeleton 2, whose first sacral vertebral spinous process was also bifid (partly separated).

Skeleton 4, a mature adult male, showed evidence for two congenital defects. The segmentation of the manubrium and sternum (breast bones) was unusual, characterised by an abnormally long manubrium and a shorter than normal sternum. This is a genetic defect of misplaced manubrio-mesosternal joint (Barnes, 1994, 211). This man also had a rib anomaly, termed 'merged rib', indicating that a bony bridge connected two adjacent ribs (Plate 1). This merging is often incomplete and means that the rib retains two heads and necks (Barnes 1994, 72). This is most common in the first and second rib, as in this individual.

Plate 1 Merged left rib of Skeleton 4

Skeleton 7, another mature adult male had six lumbar vertebrae instead of the normal five. Supernumerary vertebrae are not uncommon and usually occur in the lower spine (Barnes 1994, 78).

3.2 INFECTION

3.2.1 Non-Specific Infection

Evidence for infection was observed in Skeletons 2, 4, 5, 6, 7 and 8 (see Table 2). In all individuals with the exception of Skeleton 4, the infection was characterised by superficial inflammatory lesions on the surfaces of the tibiae. Tibiae are the most likely bones to show evidence for inflammation because they are more vulnerable to knocks than other parts of the body. The fibulae of Skeletons 5 and 7 were also affected, as well as the left ulna and right radius of Skeleton 6. In Skeleton 6, it is likely that the bone inflammation was caused by Paget's disease (discussed below). The type of skeletal lesion (lamellar bone) on the skeletons' shin bones suggested that the inflammation was receding.

Inflammatory lesions on human bones can be indicative of infectious diseases, such as leprosy and syphilis, and of non-specific localised infection, such as varicose veins, leg ulcers or trauma to the shins. However, the lesions only form in the bone if the inflammation is chronic and long-standing (Roberts and Manchester 1995, 125). Evidence for infection was common before the introduction of antibiotics and is therefore frequently observed in populations derived from archaeological contexts.

In the case of male Skeleton 2, the inflammatory lesions were associated with ossified haematomas (blood clots that have become bony). Haematomas are indicative of trauma, in this case to the shins (discussed below). It is likely that the inflammation was a consequence of the trauma (Plate 2). Skeleton 5 had suffered from a fracture of the right fibula, which was well-healed. It is likely that the periosteal inflammation of the lower limb bones of this individual was secondary to the fracture.

Plate 2 Haematoma (raised area) on shin of Skeleton 2 with striated bone infection around it

In Skeleton 7, the inflammation was also localised, rather than distributed across the whole bone shaft, as was common in the other skeletons, and suggests that the inflammation in this case was due to trauma or ulcers, rather than a diffuse infection.

The crude prevalence rate of periosteal inflammation in this population was high, with 62.5% of the population affected. The medieval average is much lower, with 14% (Roberts and Cox 2003, 235). However, the prevalence rate Torksey Main Street corresponded with that observed at the monastic site of Hull Magistrate's Court, where 64% of the population were affected (Holst *et al*, forthcoming). However, in this population the high prevalence rate was thought to have been caused by syphilis, whereas in the Torksey skeletons many of the lesions appear to have been secondary to trauma.

3.2.2 Sinusitis

Male Skeletons 4 (Plate 3) and 5 had suffered from chronic sinusitis, which was manifested in the form of new bone formation in the maxillary sinuses.

Sinusitis is a good indicator of endemic respiratory stress (viruses or pollution), as it is the body's first response against airborne particles and pathogens (Merret and Pfeiffer 2000). Unpleasant symptoms include pain in the forehead, cheeks and eyes, together with fever and a general unwell feeling (Youngson 1992, 551). The quality of life and productivity can be greatly reduced for those suffering from sinusitis.

Plate 3 Sinusitis in right sinus of Skeleton 4

The crude prevalence rate of sinusitis in this population (25%) was higher than the mean observed in medieval England (13.3%) (Roberts and Cox 2003, 233), although this may relate to the small size of the assemblage.

3.3 METABOLIC CONDITIONS

3.3.1 *Cribra Orbitalia*

Skeletons 2 and 8 suffered from fine pitting of the eye orbits, termed *cribra orbitalia* (see Table 2). The condition tends to develop during childhood and often recedes during adolescence or early adulthood. It is thought to be related to iron deficiency anaemia, which was one of the most common metabolic conditions in the past. Symptoms of iron deficiency anaemia include gastro-intestinal disturbance, shortness of breath, fatigue, pallor and palpitations (Roberts and Manchester 1995, 167).

The causes of iron deficiency anaemia are complex, as factors affecting the development of anaemia include environment, hygiene, and diet (Stuart-Macadam 1992, 160). All of these factors can affect the pathogen load (bacteria) in a population, which often contributes to a high prevalence of iron deficiency (*ibid*). In single individuals, other causes of iron deficiency include severe blood loss following injury and destruction of red blood cells (Kent 1992, 2), cancer and parasitic gut infection (Roberts and Manchester 1995, 166).

The lesions were very mild in mature male Skeleton 8 and moderate in young middle adult male Skeleton 2 (Plate 4). The crude prevalence rate (25%) of individuals suffering from *cribra orbitalia* at Torksey Main Street corresponded with that observed at other medieval sites, such as Fishergate House in York (20%) (Holst forthcoming) and Hull Magistrate's Court (27%) (Holst *et al* forthcoming). The prevalence rate of *cribra* orbitalia by orbit (21.4%) was slightly higher than the medieval average of 16.9% (Roberts and Cox 2003, 141).

Plate 4 *Cribra orbitalia* pitting in the right orbit of Skeleton 2

3.3.2 Osteoporosis

Unlike the other metabolic conditions discussed above, osteoporosis is the most common metabolic disease observed in Europe today (Roberts and Manchester 1995, 177). It is characterised by an imbalance in bone formation and resorption, causing the reduction of total bone volume, as the cortical thickness is reduced and the spongy (trabecular) bone is lost. Two types of osteoporosis exist: primary osteoporosis, which develops in women after the menopause and is related to hormone changes, or senile osteoporosis which can affect both males and females, and is caused by advancing age, disease, or a reaction to drugs (Brickley 2000, 191).

The three mature adults who were thought to be aged 60 years or older (Skeletons 4, 6 and 7) may have suffered from osteoporosis, although none of the skeletons was radiographed and the condition was therefore not verified. Osteoporosis was only tentatively suggested as a result of weight loss of the bones, and this could have been caused by the burial environment instead. Nevertheless, the presence of a 'cod fish fracture' in mature adult male (Skeleton 6) may support the diagnosis. It is possible that the osteoporosis in this individual was associated with Paget's disease, from which he suffered (discussed below). Mature male (Skeleton 7) had sustained two rib fractures, which may have been the result of bone deterioration through osteoporosis.

3.4 DEGENERATIVE JOINT DISEASE

The term joint disease encompasses a large number of conditions with different causes, which all affect the articular joints of the skeleton. Factors influencing joint disease include physical activity, occupation, workload and advancing age, which manifest as degenerative joint disease and osteoarthritis. Alternatively, joint changes may have inflammatory causes in the *spondyloarthropathies*, such as sceptic or rheumatoid arthritis. Different joint diseases affect the articular joints in a different way, and it is the type of lesion, together with the distribution of skeletal manifestations, which determines the diagnosis.

3.4.1 DJD

The most common type of joint disease observed tends to be degenerative joint disease (DJD). DJD is characterised by both bone formation (osteophytes) and bone resorption (porosity) at and around the articular surfaces of the joints, which can cause great discomfort and disability (Rogers 2001).

All of the mature adults suffered from DJD in the spine (Skeletons 3, 4, 6, 7 and 8). The lack of DJD in the younger males (Skeleton 2 and 5) supported the view that the condition was age-related. The lesions were severe in the majority of skeletons, especially in Skeletons 3, 7 and 8 (Plate 5). They affected the cervical and lumbar vertebrae most severely, although in Skeletons 7 and 8 the whole spine was involved.

Plate 5 DJD in the form of porosity and osteophyte formation in a cervical vertebra of Skeleton 3

The intervertebral discs are the 'shock absorbers' of the spine, but these can degenerate as a result of gradual desiccation, which then causes transmission of the stress from the vertebral discs to the articular facets and ligaments (Hirsh 1983, 123). Spinal osteophytes (outgrowths of bone) form in response to the constant stress that is placed on the spine as a result of human posture (Roberts and Manchester 1995, 106) to compensate. Increasing stress or activity can therefore lead to increased size and prevalence of osteophytes (*ibid*). Osteophyte formation was mild in the majority of individuals with spinal DJD; however, some of the lumbar vertebrae of Skeletons 7 and 8 were so porotic that it was astonishing that they had survived in the ground.

Spinal joint disease was common in the medieval period, affecting 21% of the population (Roberts and Cox 2003, 281).

DJD was also noted in other joints, including the hips (Skeletons 3, 4, 6 and 7), the shoulders (Skeleton 3, 4, 6, 7 and 8), the right knee (Skeletons 3, 4, 6), the left knee (Skeleton 7), the ribs (Skeletons 3, 4), the wrists (Skeleton 3 and 7), and the right ankle (Skeleton 8).

The pattern of extra-spinal joint involvement of DJD may suggest the causative agents. Asymmetrical or severe DJD is often the result of functional stress, with lesions on the joint surface in the form of porosity. Age-related DJD on the other hand, is more likely to be symmetrical, with osteophyte formation (bony outgrowths) at the joint margins. Osteophytes are a response to joint failure and an attempt to repair the joint through surrounding bone formation (Rogers 2001). The elbow and knee tend to be particularly sensitive to functional stress, while DJD of the hip and shoulder tends to be age-related (Jurmain 1991, 249). However, different prevalence rates may also indicate different ages of the onset of activities, or different levels of the same activity.

The fact that only the mature adults suffered from DJD, coupled with the distribution of the lesions suggests that the majority of degenerative manifestations were age rather than activity-related.

3.4.2 Osteoarthritis

Osteoarthritis is a degenerative joint disease characterised by the deterioration of the joint cartilage, leading to exposure of the underlying bony joint surface. The resulting bone to bone contact can produce polishing of the bone termed 'eburnation', which is the most apparent expression of osteoarthritis. Osteoarthritis can be the result of mechanical stress and other factors, including lifestyle, food acquisition and preparation, social status, sex and general health (Larsen 1997, 179).

Mature adult female Skeleton 3 and mature adult male Skeleton 7 suffered from osteoarthritis. Three carpals (wrist bones) of Skeleton 3 showed evidence for eburnation. It is probable that both age and possibly also trauma had contributed to the onset of this condition. Modern studies have found no correlation between the expression of osteoarthritis and the severity of pain (Cockburn *et al* 1979). It is therefore not clear, whether this woman would have suffered discomfort as a result of the lesions in her left wrist.

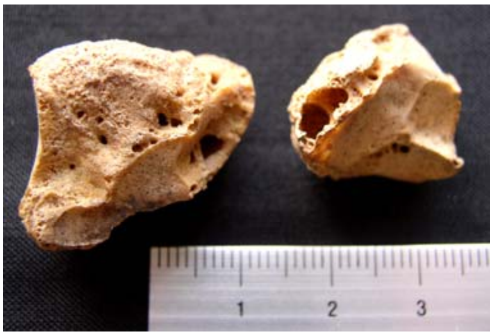

Plate 6 Osteoarthritis in two wrist bones of Skeleton 7 (note cysts)

Skeleton 7 exhibited more widespread osteoarthritis, in some of the thoracic vertebral facets, left elbow and particularly severely in both wrists (Plates 6 and 7). Eburnation was noted in the right and left wrist bones, together with porosity and cyst formation, causing many of the wrist bones to be almost hollow.

Plate 7 Osteoarthritis with eburnation at right radius in Skeleton 7 (note shiny surface on left part of joint)

Bridges (1991) suggests that osteoarthritis is secondary to trauma, or high intensity but infrequent activities, rather than constant stress, while Waldron and Cox (1989) have found that it is also strongly age-related. It is possible that the two individuals with osteoarthritis had suffered from underlying trauma, although this could not be detected in the bone.

3.4.3 Schmorl's Nodes

A different condition which affects the spine is Schmorl's nodes. Schmorl's nodes are indentations in the upper and lower surfaces of the vertebral bodies, most commonly in the lower thoracic vertebrae (Hilton *et al* 1976). Schmorl's nodes can result from damage to the intervertebral discs, which then impinge onto the vertebral body surface (Rogers 2001), and may cause necrosis (death) of the surrounding tissue. Rupture of the discs only occurs if sufficient axial compressive forces are causing pressure on the central part of the discs; frequent lifting or carrying of heavy loads can cause this.

Schmorl's nodes were observed in all adult spines (Plate 8), although the individuals showed evidence for only one or two lesions each, none of which were severe. The lesions were located exclusively in the lower thoracic and lumbar vertebrae. This suggests that the population was not exposed to severe pressure as a result of axial loading (heavy lifting). Schmorl's nodes were common in the medieval period, both in males and females.

Plate 8 Schmorl's nodes on lumbar vertebra of Skeleton 5

3.4.4 Intervertebral *Osteochondrosis*

Intervertebral *osteochondrosis* is a condition also associated with intervertebral disc degeneration. It is characterised by rugged crescent-shaped lesions at the anterior part of the vertebral body surfaces (Kelley 1982). Similar to Schmorl's nodes, intervertebral *osteochondrosis* is probably caused by stress, however, *osteochondrosis* is thought to develop later than Schmorl's nodes, between the second and third decade of life.

Skeleton 2 suffered from intervertebral *osteochondrosis* of the tenth and eleventh thoracic vertebra. The lesions were characteristically crescent-shaped, with destruction of the anterior rim.

3.5 TRAUMA

3.5.1 Fractures

The type and distribution of broken bones depends on the environment the population lived in and is therefore often population-specific. Factors influencing fracture frequency include rough terrain, hard physical labour or dangerous work and interpersonal violence.

Two males (Skeletons 2 and 7) had sustained rib fractures. Skeleton 2, a young middle adult male, exhibited nine rib fractures, at the shafts and necks of the lower ribs from both sides of the body. All the fractures were well-healed. It is likely that ribs on both sides of the body were fractured, because when more than three ribs on one side of the chest are fractured, the other side rarely remains intact (Dandy and Edwards 1998, 162). Fractures of a number of ribs can interfere with breathing, which may cause serious complications, whereas isolated cracks can heal quickly and are often treated in the same way as severe bruises (*ibid*, 159).

Tomczak and Buikstra (1999, 255) found that impact from the back tends to fracture ribs near the spine, and force from the side of the chest fractures the ribs either near the spine, or the front of the chest, near the sternum. Compression injuries of the chest, on the other hand, cause rib fractures at the curved parts of the ribs, at the side of the body (*ibid*). Most rib fractures were located at the shafts of the rib, suggesting they were caused by side impact. However, a number of fractures were noted at both the shaft and angle, which might be indicative of an antero-lateral impact.

Plate 9 Two rib fractures in Skeleton 7

Two further rib fractures were noted in mature male Skeleton 7 on the lower left rib shafts (Plate 9). Again, the fractures were well-healed. In this case, the fractures may have been secondary to weakening of the bone as a result of osteoporosis (discussed above).

Rib fractures are commonly encountered in medieval cemeteries, with 6% of individuals affected at Fishergate House in York (Holst forthcoming) and 4.4% at the monastic site at Hull Magistrate's Court (Holst *et al* forthcoming).

A further possible osteoporotic fracture was the depression fracture ('cod fish fracture') of the second lumbar vertebra of a mature adult male (Skeleton 6). Compression injuries are caused by vertical force, such as falling and landing on the feet or bottom (Dandy and Edwards 1998, 155). At the monastic site of St Andrew's, Fishergate in York, spinal fractures were the most common type of fracture following broken long bones (Stroud and Kemp 1993).

An isolated fracture of the right proximal fibula (knee) of a young middle adult male (Skeleton 5) was probably caused by a twisting injury (Dandy and Edwards 1998, 260). The fracture was well-healed; healing inflammatory lesions on this fibula may be a consequence of the fracture, but may alternatively be related to a separate cause.

3.5.2 Activity-Related Trauma

Occasionally, it is possible to infer trauma to the soft tissue on the bones, in the form of ligamentous or muscular trauma. This is expressed through the formation of bony processes (*enthesopathies*) at the site of ligament attachments. Additionally, it is possible to observe bone defects at the site of muscle insertions, which are the result of constant micro-trauma and are usually activity-related (Hawkey and Merbs 1995, 334).

The majority of muscular trauma was noted in the arms, particularly the humeri of this group. Skeletons 4 and 6 exhibited bone defects or *enthesopathies* at the attachment sites of *pectoralis major* on the humerus. This muscle attachment was also well-developed in those adults who did not exhibit trauma at this site. Further upper arm muscle trauma was noted in Skeleton 2 at the attachment sites for *teres major*. Trauma to *supraspinatus* and *subscapularis* were observed in Skeletons 3 and 7. All of these muscles are responsible for movements of the upper arm and shoulder (Stone and Stone 1990).

The arms of Skeletons 4 and 6 exhibited trauma at the attachment site of *triceps*, which extends the forearm, and aids in adduction. Further arm muscular trauma was noted in Skeletons 2, 3 and 4 at the attachment site of *biceps*, a muscle which flexes the arm at the shoulder and the forearm and supinates (turns) the hand (Stone and Stone 1990, 102).

Evidence for activity-related strain to the lower limbs was also observed. Skeletons 1, 6, 7 and 8 had bone defects at the attachments of the *soleus* muscle, which flexes the foot downwards (Stone and Stone 1990, 185), which may be related to walking or squatting.

Skeletons 2, 4, 6, 7 and 8 showed evidence for muscular strain on the femora for *gluteus maximus*, the main muscle of the bottom (extends and laterally rotates the hip joint and extends the trunk), and Skeletons 2 and 7 also had *enthesopathies* at the attachments for *adductor longus*, (adducts the thigh at the hip and assist in lateral rotation and extension of the leg) (Stone and Stone 1990, 178).

Skeletons 3, 6 and 8 had slight *enthesopathies* at the femora, indicative of mechanical stress on the *obturator externus* muscle, which laterally rotates the thigh (Stone and Stone 1990, 159).

Os acromiale is characterised by non-fusion of the acromion process of the scapula to the spine of the scapula. This developmental anomaly is thought to be caused by stress to the rotator cuff muscles during growth. The stress is believed to be so severe in these cases that it prevents natural fusion of the bones. Knüsel (2000) has argued that this condition might be linked to archery in the skeletal population from a mass grave from the War of the Roses at Towton (1461). Young middle adult male (Skeleton 2) suffered from bilateral *os acromiale*, which might be related to archery, although it could be the result of other activities, which require greater mobility of the shoulder joint.

3.5.3 Weapon Trauma

A blunt force injury was noted on the left side of the forehead of mature male Skeleton 7 (Plate 10). The injury was well-healed and relatively superficial. Its shape suggested that it had been inflicted with a linear object, leaving a 21.7mm long depression on the skull. Cranial injuries are often observed on the left side of the skull, as the attacker tends to be right-handed. However, this injury may not have been inflicted by an assailant, but may have been the result of an accident. It is possible that the cranial trauma was related to two rib fractures this individual had sustained some time before death.

Plate 10 Blunt force trauma in skull of Skeleton 7

Weapon injuries are relatively common in medieval populations, with a crude prevalence rate of 2.1% (Roberts and Cox 2003, 275). They are much more common in men compared with women and are frequently observed at monastic sites, such as St Andrew's, Fishergate in York (Stroud and Kemp 1993).

3.5.4 Soft Tissue Trauma

It is frequently possible to observe evidence for soft tissue trauma on skeletal remains from archaeological contexts, including ossified haematomas (blood clots). Two possible haematomas were noted on the tibiae (upper parts of the shins) of a young adult male (Skeleton 2). Haematomas can be the result of direct blunt force trauma, or tearing of muscle fibres, causing blood to collect and clot. If the muscle is exercised too soon following the injury, the blood clot may ossify, producing a bony lump at the site of the haematoma.

The ossified haematomas were located on the most anterior parts of the shins, at the mid shaft of the left tibia and approximately 3cm higher on the bone of the right tibia. The similar nature of the lesions, which were linear and raised (see Plate 2), suggests that they relate to the same accident, and are probably the result of direct trauma. It is possible that an object fell or rolled into the shins. The haematomas were associated with healing inflammation, and muscle damage to the *soleus* muscle, suggesting that the accident caused both inflammation and muscular trauma.

3.5.5 Circulatory Disorders

Osteochondritis dissecans is characterised by necrosis (death) of part of the joint area, with separation of a small bone fragment from the joint surface, which can become completely disconnected and remain as a loose body within the joint capsule, or may be reabsorbed or reattached. The condition tends to have little effect in adolescents, who are most likely to suffer from *osteochondritis dissecans*. Adults with the condition, on the other hand, can suffer pain, interlocking and instability of the joint (Clanton and DeLee 1982, 59). The initiating mechanism for *osteochondritis* is now thought to be multifactoral, but is related to trauma at a susceptible location (Frederico *et al* 1990). A young middle adult male (Skeleton 2) suffered from *osteochondritis* in one of the ankle bones (navicular) of the right foot, while another male of the same age (Skeleton 5) had a similar lesion in the big toe.

3.6 NEOPLASTIC DISEASE

The most common tumours observed in palaeopathology are benign tumours, especially ivory or button osteomas. Osteomas are small, dense and round, protrude from the bone and form within the bone surface (periosteum) (Capasso 1997). They produce no pain and are most frequently noted on the skull, especially the frontal or parietals (sides of the skull), and can occur in single or multiple forms. The frequency of osteomas has been found to rise with increasing age.

A small ivory button osteoma was observed on the frontal bone (forehead) of mature adult male Skeleton 6. The tumour was incorporated into the skull bone and hardly visible.

3.7 MISCELLANEOUS PATHOLOGY

Arachnoid granulations are small, well-defined depressions on the inner (endocranial) surface of the skull. They tend to cluster at the frontal and parietal, especially at the border between these three skull parts (Mann and Murphy 1990, 26). They are common in all populations and have a tendency to increase in number and depth with advancing age. The cause for the formation of *arachnoid granulations* has not yet been understood. Older females tend to be predominantly affected, especially following menopause, although males do exhibit the lesions as well. Skeletons 4 and 7, a mature adult female and male, exhibited small clusters of *arachnoid granulations* on the endocranial (inner) surface of the skull.

Mature male Skeleton 6 is thought to have suffered from Paget's disease. The causes of Paget's disease are not yet understood, although it may be a viral disease and is seen mostly in individuals over the age of 60 (Roberts and Cox 2003, 284). The disease initiates enlargement and deformity of the bones and is often localised in several elements of the skeleton (Aaron *et al* 1992, 328). '*Paget's quickens the pace of* [normal bone] *breakdown and reformation, with the result that the layers of new bone are structurally disorganized, misshapen and considerably larger than the original bones.*'(Byock 1995, 66). The majority of individuals with the condition suffer no symptoms, although it can cause bone pain, dysfunction of the cranial nerves and spinal cord compression, which can eventually become incapacitating (Aufderheide and Rodriguez-Martin, 1998, 414).

Skeleton 6 suffered from considerable thickening of the skull (Plate 6), the left clavicle, all arm bones, the femora, the distal right tibia and the left calcaneus. The vertebrae were very porous with a fracture of one of the vertebrae, which is normally associated with osteoporosis and the trabecular (spongy) bone spacing was greatly enhanced in all bones. The right tibia, left ulna and right radius exhibited thickening in conjunction with periosteal bone inflammation, which was largely hypervascular (porous). The remaining bones were normal in appearance and no evidence for paralysis was observed. The skeletal evidence suggests that this individual suffered from Paget's disease, however, only radiography and histological bone analysis could verify this diagnosis. Other cases of possible Paget's disease have been reported from Pennell Street, Lincoln (Boghi and Boylston 1997) and Jewbury in York (Lilley *et al* 1994).

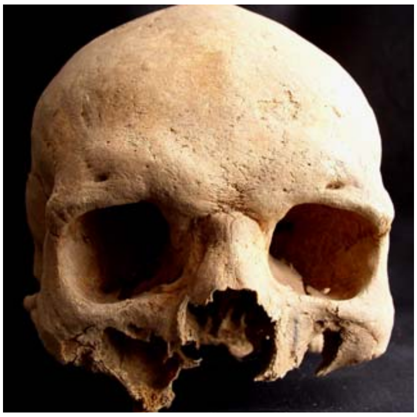

Plate 11 Thickened skull as a result of Paget's disease in Skeleton 6

The skull of mature female (Skeleton 3) was unusually masculine in its facial characteristics. The woman had well-defined eyebrow ridges, a square chin and rounded drooping eye orbits. It was attempted to establish her ancestry, in case her different cranial shape was not Caucasian, however, evidence for diverse ancestry could not be found. It is possible that her masculine facial characteristics had simply developed as a result of old age.

3.8 CONCLUSION

Childhood stress in the form of iron deficiency anaemia was noted in two individuals (Skeletons 2 and 8). The prevalence of the lesions was much higher than the medieval average, suggesting that perhaps the pathogen load of this population was high, which in turn is often responsible for iron deficiency.

This was also indicated by the presence of inflammatory lesions on the tibiae of all five males (Skeletons 2, 5, 6, 7 and 8), which may have been due to ulcers, trauma to the shins, varicose veins, or to infectious diseases such as leprosy or syphilis. However, comparative analysis of different conditions in the skeletons found that three cases of inflammation were probably secondary to trauma, while a further case of a consequence of a viral disease. Further evidence for infection was noted in the form of chronic sinusitis in Skeletons 4 and 5. It is possible that his chronic sinusitis was caused by exposure to pollution.

The skeletal evidence suggests that all of the older members of this population suffered from degenerative disease, which was mostly concentrated in the spine, hips, shoulders and knees and is thought to have been due to their old age. Two of the mature adults also suffered from osteoarthritis, which is likely to have been secondary to traumatic injuries that had occurred some time before death. The arthritic lesions in the wrists of Skeleton 7 were particularly severe, and may have been related to an undetected injury of the wrists, perhaps associated with the individual's two rib fractures, or may have been activity-related.

Muscular trauma to the arms and thighs suggest that the adults carried out activities that placed strain on the rotator cuff muscles that extend and flex the forearm and those muscles that control movement of the hips and thighs. Notably, little trauma was observed in the spines, suggesting that this population was not subject to heavy axial loading, so often observed in other medieval populations.

It is possible that the well-healed rib fractures of male Skeletons 7 and 2, the cranial trauma (Skeleton 7) and haematomas on Skeleton 2's shins were caused by work-related accidents. Alternatively, the trauma may have been caused by other accidents or through inter-personal conflict.

It is probable that Skeleton 6 suffered from Paget's disease, which caused thickening of his bones, and mild bone inflammation. No evidence was found to suggest that the disease was so advanced that it had caused incapacity.

A benign tumour was noted in the skull of Skeleton 6. These tumours are common in archaeological contexts and would have had no effect on the individual. Some minor congenital anomalies were noted in four individuals, which they would not have been aware of.

Evidence for DJD, mild Schmorl's nodes and iron deficiency was also observed in the skeletons previously excavated at Torksey Main Street (see Table 3) (Booth 2002).

4.0 DENTAL HEALTH

Analysis of the teeth from archaeological populations provides vital clues about health, diet and oral hygiene, as well as information about environmental and congenital conditions. Of the total 214 tooth positions present, 171 permanent teeth and six deciduous teeth were recovered (Table 4). Three third molars of Skeleton 3 were not present and it was not clear, whether these were impacted in the jaw, or had simply not developed.

Table 4 Summary of dental pathology

Skeleton No	Teeth Present	Calculus	AM Loss	PM Loss	Caries	Abscess	DEH	Infraction	Wear	Periodontitis
1	6 deciduous, 16 permanent	12	-	-	-	-	5	-	Slight to moderate	None
2	31	20	1	-	2	1	12	2	Slight	Considerable
3	26	24	3	-	7	3	4	-	Considerable	Considerable
4	28	25	-	4	-	-	8	1	Considerable	Considerable
5	27	25	-	1	1	-	1	-	Moderate	Considerable
6	20	2	11	1	1	4	6	6	Considerable	Considerable
7	8	4	17	2	1	2	1	-	Considerable	Considerable
8	15	13	-	1	1	2	6	2	Considerable	Considerable

A total of nine teeth had been lost post-mortem; while a further 32 teeth had been lost ante-mortem. The ante-mortem tooth loss was partly caused by dental abscesses in the case of Skeletons 2, 3, 6 and by the considerable periodontitis observed in all of the adult skeletons. The prevalence rate of ante-mortem tooth loss (14.9%) was lower than the medieval prevalence rate of 19.4% (Roberts and Cox 2003, 263).

Dental wear tends to be more common and severe in archaeological populations than in modern teeth. Severity of the dental wear was assessed using a chart developed by Smith (1984). Each tooth was scored using a grading system ranging from 1 (no wear) to 8 (severe attrition of the whole tooth crown). Dental wear was largely considerable, and was clearly age-related. It was least severe in the juvenile (Skeleton 1) and the two young middle adult males (Skeletons 2 and 5).

Calculus (dental plaque) is commonly observed in archaeological populations whose dental hygiene was not as rigorous as it is today. Calculus mineralises and forms concretions on the tooth crowns, along the line of the gums. Calculus was observed in the 73.1% of teeth (125 teeth), and was slight to moderate, with the exception of young middle adult male Skeleton 5, who had thick deposits of plaque concretions on his teeth, which coated all the tooth surfaces (Plate 12). This suggests that the calculus deposits were not age-related, but were rather the result of poor oral hygiene. This is also supported by the extensive calculus deposits observed in the teeth of the seven to eight year old juvenile (Skeleton 1). The calculus prevalence rate at this site was much higher than the medieval mean of 54.0% (Roberts and Cox 2003, 132).

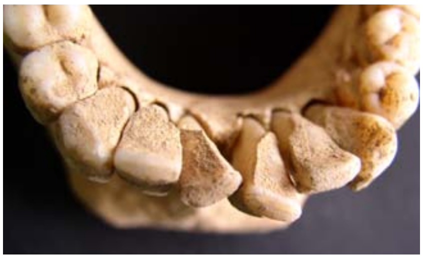

Plate 12 Calculus deposits on teeth in lower jaw of Skeleton 5, note also crowding of teeth

Periodontitis (receding gums) was severe in all adult skeletons (see Table 4) and was therefore not solely age-related, but was probably exacerbated by the extensive calculus deposits, which often irritate the teeth. The crude prevalence rate (87.5%) of periodontal disease at Torksey Main Street was much higher than the medieval mean, with 37.53% (Roberts and Cox 2003, 261).

It is possible that bumps or falls caused the infractions (dental chipping) of the first upper incisors of Skeleton 2 and the upper right first incisor and left second incisor of Skeleton 8. Wear on the chipped parts of the three teeth implies that these injuries had occurred some time before death. Skeleton 4, a mature female, had sustained a complete fracture of her lower right first molar, suggesting considerable trauma to the tooth, which she had sustained some time before death, as the tooth exhibited extensive wear. Skeleton 6 exhibited slight infractions and grooved wear of all anterior teeth in both the upper and lower jaw, suggesting that this mature man's dental wear may have been activity-related, rather than caused by accidents.

Abscesses were relatively common (5.6% of tooth positions affected) in this population (see Table 4), and were located around the roots of the teeth. The infections were localised, causing holes to form at the base of the tooth roots, which had released pus from the bone into the mouth. In Skeleton 7, one of the abscesses had penetrated into the maxillary sinus and caused a localised infection in the sinus. Many of the teeth affected by abscesses had been lost ante-mortem, but it is probable that the infections had developed as a result of caries lesions (cavities).

It is probable that the infections were extremely painful. Even today, with the availability of antibiotics, dental abscesses can be very persistent. In the past, however, they must have played a more significant role, debilitating and causing extreme pain, weakening the immune system and, if the infection entered the bloodstream, causing fatal septicaemia. In this case, the majority of the abscesses were well-healed, suggesting that the individuals had survived the infections. The prevalence rate of abscesses in this population was higher than the medieval prevalence rate, at 3.1% (Roberts and Cox 2003, 260).

Cavities are multifactoral in origin, but develop as a result of aggressive bacterial attack in the presence of sucrose (Hillson 1996, 282) and fermentable carbohydrates (Roberts and Manchester 1995, 47). All the skeletons apart from the juvenile (Skeleton 1) and mature female Skeleton 4 suffered from caries lesions (see Table 4). In the majority of cases, the lesions affected the molars, but an incisor and canine were involved in Skeleton 3 (Plate 13) and premolars in the case of Skeletons 5 and 7. The teeth at the back of the mouth are hardest to clean and are therefore most likely to be affected by caries. The prevalence rate of caries at Torksey Main Street was 7.6%, which is slightly higher than the overall medieval prevalence rate of 5.6% (Roberts and Cox 2003, 259).

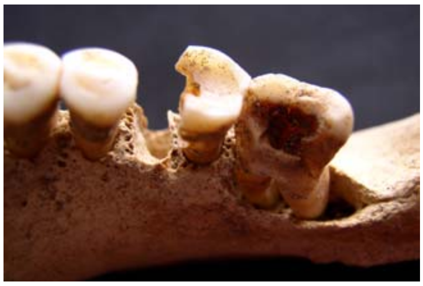

Plate 13 Cavities in lower jaw of Skeleton 3

Skeletons 4 and 5 and juvenile Skeleton 1 had crowded anterior teeth in the upper jaw, indicative of limited space in the gums for the number of teeth present. A further dental anomaly noted was the presence of a 'tooth bud' in the jaw of young middle adult male Skeleton 5 (Plate 14). This was a tiny malformed tooth, with a root that was only 1mm long and a small hollow tooth crown. This tooth had obviously failed to develop normally, but it was not clear which tooth it represented, as parts of the upper jaw of this individual was not preserved.

Plate 14 Tooth bud beside normal tooth (Skeleton 5)

The most prevalent dental pathology in this population was dental enamel *hypoplasia* (DEH), which affected every individual from the site. DEH is the manifestation of lines, grooves or pits on the crown surface of the teeth, which represent the cessation of crown formation. The defects are caused by periods of severe stress during the first to seventh year of childhood, including malnutrition or disease. DEH was observed in 43 teeth (25.1%), the majority of which were anterior teeth, with the exception of premolars in Skeletons 7 and 8 and a first molar in Skeleton 8.

The prevalence of DEH at Torksey was considerably higher than that reported for the medieval period, at 8.1% (Holst forthcoming). Notably, the majority of individuals had more than one line of DEH in their teeth and up to five lines in Skeleton 4, indicative of several episodes of stress. It is likely that the DEH lesions formed between the ages of eighteen months and four and a half years, as was also observed at other medieval sites (Roberts and Cox 2003, 264).

Plate 15 DEH lines and calculus on the upper incisors of Skeleton 1

The dental health of the population was poor, with a higher than average prevalence rate of calculus, caries, and abscesses. Wear was generally severe and several infractions were noted, some of which were probably related to accidental trauma, while those of mature male Skeleton 6 were probably activity-related. Periodontal disease was widespread and severe, and was likely to have been caused by the prevalent calculus deposits. The evidence suggests that these individuals practised little oral hygiene, causing cavities, plaque-build-up and resulting from that, tooth loss and abscesses.

The most common dental pathology was DEH, which was seen in every member of this population. All of the individuals had more than one DEH line on the teeth, implying that they had suffered from several episodes of stress during childhood. Male middle adult Skeleton 2 was affected most severely; he had twelve teeth with DEH. The evidence suggests that all of these individuals had experienced several episodes of hardship during childhood and this may have lowered the immune system and eventually caused the death of juvenile Skeleton 1.

The dental pathology of the individuals previously excavated at Torksey Main Street mirrored that from the recently analysed assemblage. DEH lesions were also widespread and had occurred at the same ages. Eight caries lesions were observed, some of which were severe and one of the lesions had caused the formation of an abscess (Booth 2002, 3).

5.0 MORTUARY PRACTICE

Six of the skeletons found at Torksey Main Street were interred in single graves, while two skeletons were buried in walled stone cists. All the skeletons were buried in a similar, typically Christian manner, in supine extended positions, with the arms beside the body or crossed over the abdomen or chest. The skeletons were orientated with the heads to the west and the feet to the east (see Table 1). The mortuary ritual of seven burials excavated in 2001 was similar in character, with four of these buried in stone cists. However, one of the cists contained two skeletons (466), including a middle-aged female and a young child (Booth 2002).

Cist burials were relatively common at parish churches, cathedral and monastic cemeteries in the pre-Conquest and later medieval period. At the Minster and later medieval priory of St Oswald at Gloucester, four of the 600 burials were found in stone cists, ranging in date from the Anglo-Saxon to the late medieval periods (Webber, 1999, 218). At the parish church of St Mark's in Lincoln, cist graves were found to date from the 11th century to 1720 (Gilmour and Stocker 1986). A total of 416 cists were recorded at Winchester Cathedral (Kjølbe-Biddle 1975, 89). Notably, at this site, the cist graves were not associated with higher status grave goods compared with simple earth graves (*ibid*, 91). The presence of cist graves at different types of sites suggests that cists are not necessarily related to higher status. However, the presence of gold thread around the right wrist of Skeleton 6 from Torksey, a mature male who was buried in a cist grave, did imply a higher social status.

A parallel to this burial may be seen at Winchester Cathedral, where a cist contained a 35 to 45 year old man, thought to be a priest (Kjølbe-Biddle, 1992, 239). He was buried with a chalice, paten, and a copper alloy buckle and hook. On his right chest were gold threads, which were thought to derive from a tablet-woven braid (*ibid*). This grave was the most elaborate burial excavated at the Paradise cemetery at Winchester Cathedral.

The thread suggests that mature male Skeleton 6 wore an exclusive garment. Considering the relative rarity of grave goods in medieval burials, with the exception of pewter chalices and patens indicative of priests and pilgrim badges or staffs, the presence of the gold thread in this burial is remarkable.

Neither the date of the assemblage, nor its provenance is currently clear. It is possible that the burials date to the pre-Conquest period, or they may be later medieval. Similarly, they may belong to the Augustinian Priory of St Leonard's, or could be associated with the parish church of St Peter's, which is located within 200m from the burials.

6.0 DISCUSSION AND SUMMARY

Osteological analysis of the skeletal assemblage from Torksey Main Street has provided a glimpse into the lives of the people buried there. The small group of inhumed skeletons included three mature males and two mature females, three of whom were thought to be at least 60 years old. Additionally, two middle-aged males were found. The population also included a single child, aged seven to eight years. A previous excavation at the site, 50m from the current watching brief, found the remains of three further juveniles, an infant, a middle-aged female and three young males (Booth 2002).

The average age at the Torksey cemetery was 42 years, which is relatively old compared with other medieval cemeteries. It is possible that the cemetery was associated with the Augustinian Priory of St Leonard's. A monastic association may explain the high representation of individuals of older ages in the recently studied assemblage, as older males are often found at monastic cemeteries. However, the small sample size does not permit demographic interpretations and it is also possible that this group belongs to the parish church of St Peter's.

The presence of cist graves, which are observed in parish church, cathedral and monastic cemeteries and can date from the Anglo-Saxon to the post-medieval periods does not provide any clues as to the provenance or the date of the cemetery. However, the existence of gold thread around the wrist of a mature male, who was interred in a cist, is indicative of a high status burial and may point to this being a monastic burial.

In common with most other medieval cemeteries, the burials were interred in an orderly Christian manner. All individuals were buried in extended supine positions, with the heads to the west and the feet to the east.

The skeletal remains were largely in an excellent condition and complete. Evidence for age-related conditions was noted in all of the mature adults, largely in the form of degenerative disease. This was concentrated around the spines, hips and shoulders, as well as some knees and wrists. More severe joint disease in the form of osteoarthritis was noted in a mature adult male and female. It is probable that the lesions were secondary to traumatic injuries that had occurred earlier in life.

Further age-related disease was noted in the form of internal cranial pitting in two of the mature adults (Skeletons 4 and 7) and in the form of a benign tumour. Three individuals are also thought to have suffered from age-related osteoporosis. Paget's disease, which causes destruction and eventual expansion of bones, was observed in one mature male (Skeleton 6). This disease is rarely diagnosed in individuals under the age of 60 and is thought to have a viral origin.

The presence of a healed blunt force skull injury and two rib fractures in one mature man, nine rib fractures in a middle-aged man and blood clots on the same individual's shins may be related to inter-personal violence, or to accidents, which could be work-related. Inflammatory lesions observed in five individuals were thought to be related to non-specific infections, rather than infectious diseases, such as syphilis or leprosy. The lesions were secondary to shin trauma in one individual, and to a knee fracture in another man. The inflammation was thought to be associated with Paget's disease in mature male Skeleton 6. In two cases, the cause for the lesions could not be determined.

Evidence for trauma to those muscles responsible for moving the arm and shoulder was noted in all adults. Some individuals also showed evidence for strain to those muscles moving the hips and thighs. This, together with the joint disease noted in the adults, suggests that they were physically active, although the limited presence of lesions to the spines indicative of carrying heavy loads suggests that physical strain was minimal. One individual showed evidence for wear on the front teeth, indicative of using the teeth as tools, perhaps in work-related tasks. A further possible activity-related anomaly was the lack of fusion in both shoulder joints of Skeleton 2, a middle-aged male. This anomaly is usually associated with individuals who have been practicing activities from adolescence onwards, which require a greater than normal degree of flexibility of the shoulders, such as archery.

A mature female and a middle-aged man suffered from chronic sinusitis, which may have been caused by pollution. Sinusitis can weaken the immune system considerably and it is probable that the chronic infection caused considerable discomfort and would have rendered these individuals more susceptible to disease.

Two individuals suffered from iron deficiency anaemia, which may be related to exposure to a high pathogen load during childhood. This is also supported by the presence of *dental enamel hypoplasia*, which was noted in all individuals from the site. The evidence suggests that this population was subject to episodes of malnutrition or disease between eighteen months of age and four and a half years. This theory is further supported by the death of the young juvenile, who probably succumbed to one of these periods of stress, after suffering from stunted growth and delayed long bone fusion. Notably, despite these periods of stress during childhood, the majority of individuals are relatively tall, suggesting that the childhood stress did not have a long term effect on their eventual height.

A small number of skeletons showed evidence for minor congenital anomalies. None of these would have affected these individuals.

Dental hygiene was very poor in this population, with a higher than usual medieval rate of plaque, cavities and dental abscesses. It is thought that poor tooth cleaning exacerbated the formation of plaque and cavities, which in turn caused severe periodontal disease and many abscesses, often leading to ante-mortem tooth loss.

The analysis of the burials at Torksey Main Street provides an insight into medieval health in Lincolnshire. The individuals were buried in plain earth graves and stone cists, regardless of their age. The skeletal evidence suggests that all of the individuals suffered from episodes of stress during childhood, perhaps related to a high pathogen load, or to malnutrition, causing some children to die. Age-related disease was common in this population, as well as injuries followed by secondary inflammation.

Notably, an individual who was buried in a stone cist with gold thread at his right hand had also suffered from childhood stress and later evidence for muscular trauma and activity-related dental wear. This suggests that even those of higher social position were exposed to those factors causing childhood stress and were not exempt from physical work during adulthood.

7.0 FUTURE RECOMMENDATIONS

It is recommended that the individuals excavated at Torksey Main Street undergo radiocarbon dating. Targeted radiocarbon dating of skeletons would provide accuracy in assigning the skeletons to a specific period and may aid in interpreting their provenance.

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APPENDIX A: OSTEOLOGICAL AND PALAEOPATHOLOGICAL CATALOGUE

Inhumed Skeletons

Skeleton Number	**1**
Preservation	Excellent
Completeness	92%, all but lower sacrum, some ribs, right hand
Age	Juvenile, 7-8
Sex	-
Stature	-
Non-Metric Traits	Ossicle at parietal notch (right), bridging of supraorbital notch (left)
Pathology	Bifid L5, bone excavations for soleus
Dental Health	6 deciduous, 16 permanent teeth, calculus on 12/22 teeth, slight wear, DEH on 5/22 teeth, crowding

	Right Dentition								Left Dentition							
Present	-	-	P	P	P	-	P	P	P	P	-	P	P	P	-	-
Calculus	-	-	-	-	-	-	Sb	Sb	-	Sb	-	-	-	-	-	-
DEH	-	-	-	-	-	-	L	L	L	L	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	1	1	1	-	1	1	1	1	-	1	1	1	-	-
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	-	-	P	-	-	-	P	P	P	P	-	-	-	P	-	-
Calculus	-	-	Ml	-	-	-	Mb	Mb	Fa	Fa	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	L	L	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	1	-	-	-	1	1	1	1	-	-	-	-	-	-

Skeleton Number	**2**
Preservation	Excellent
Completeness	98%, all
Age	Young middle adult, 26-35
Sex	Male
Stature	168.4 ± 2.99cm
Non-Metric Traits	Ossicle in lambdoid (left), mastoid foramen extrasutural (bilateral), precondylar tubercle, double anterior condylar canal (left), incomplete foramen ovale (left), maxillary torus (bilateral), Poirier's facet (bilateral), vastus notch (bilateral), lateral tibial squatting facet (bilateral), peroneal tubercle (bilateral), double anterior calcaneal facet (right), double inferior talar facet (right), os trigonum (bilateral)
Pathology	*Cribra orbitalia*, *os acromiale*, periostitis of tibiae, haematoma of tibiae, osteochondritis dissecans, intervertebral osteochondrosis, 9 rib fractures, bifid S1, enthesopathies for gluteus maximus, biceps, bone excavations for teres major, latissimus dorsi, costoclavicular ligament
Dental Health	Calculus on 20/31 teeth, caries on 2/31 teeth, DEH on 12/31 teeth, 1 abscess, infractions 2/31, slight wear, considerable periodontitis

	Right Dentition								Left Dentition							
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	Sl	Sa	Sa	-	-	-	Fb	Fb	-	Fb	Fb	-	-	Sa	Sa	Sl
DEH	-	-	-	-	-	L	L	L	L	L	L	-	-	-	-	-
Caries	So	-	-	-	-	-	-	-	-	-	-	-	-	Sm	-	-

Wear	3	3	3	2	2	2	2	2	2	2	2	2	4	5	3	3
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	P	P	AM	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	Sl	Sl	-	-	-	Ma	Ma	Ma	Ma	Ma	Ma	-	-	-	Sl	Sl
DEH	-	-	-	-	-	L	L	L	L	L	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	3	3	-	2	2	2	2	2	2	2	2	2	2	4	4	3

Skeleton Number	**3**
Preservation	Excellent
Completeness	99%, all
Age	Mature adult 46+
Sex	Female
Stature	170. 5 ± 3.55 cm
Non-Metric Traits	Mastoid foramen extrasutural (right), incomplete foramen ovale (bilateral), maxillary torus (bilateral), accessory supraorbital foramen (left), accessory sacral facet (bilateral), acetabular crease (bilateral), exostosis in trochanteric fossa (bilateral), double anterior calcaneal facet (bilateral), double inferior talar facet (bilateral)
Pathology	DJD in spine, hips, shoulders, Schmorl's nodes, osteoarthritis in left wrist, bone excavations for biceps, supraspinatus, subscapularis
Dental Health	Calculus on 24/26 teeth, caries 7/26 teeth, DEH 4/26 teeth, 3 abscesses, considerable wear, considerable periodontitis

	Right Dentition								Left Dentition							
Present	NP	AM	P	AM	P	P	P	P	P	P	P	P	P	P	P	NP
Calculus	-	-	Ma	-	Mb	Sb	Sa	Sa	Fa	Mb	Mb	Sa	Sa	Sa	Ha	-
DEH	-	-	-	-	-	L	-	-	-	L	L	-	-	-	-	-
Caries	-	-	-	-	-	La	La	-	-	-	-	-	-	Md	-	-
Wear	-	-	5	-	6	5	-	5	5	4	4	5	6	6	4	-
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	NP	P	P	P	P	P	P	P	P	P	P	P	P	AM	P	P
Calculus	-	-	-	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	-	Ha	Ma
DEH	-	-	-	-	-	-	-	-	-	-	L	-	-	-	-	-
Caries	-	Lm	Lm	-	-	-	-	-	-	-	-	-	-	-	So	So
Wear	2	3	4	2	3	2	3	4	4	3	2	3	2	4	3	2

Skeleton Number	**4**
Preservation	Good
Completeness	96%, all
Age	46+, mature adult
Sex	Female
Stature	167.7 ± 3.55 cm
Non-Metric Traits	Ossicle in lambdoid (right), ossicles at asterion (bilateral), incomplete foramen ovale (left), Poirier's facet (bilateral)
Pathology	DJD in spine, pelvis, right patella, left scapula, sinusitis, osteoporosis, arachnoid granulations, congenital anomalies of first rib, sternum, enthesopathies for biceps, Achilles tendon, triceps,

	bone excavations for gluteus maximus, pectoralis major															
Dental Health	Calculus on 25/27 teeth, DEH of 8/27 teeth, fracture of lower right M1, considerable wear, considerable periodontitis, anterior crowding															
	Right Dentition								Left Dentition							
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	Sa	Sa	Sa	Sb	Sb	Sb	Sb	Sb	Sd	Mb	Mb	Sb	-	-	-	Sa
DEH	-	-	-	-	-	L	L	L	L	L	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	4	5	6	6	6	5	6	5	5	4	4	3	4	6	4	4
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	P	P	P	P	P	P	PM	PM	PM	P	P	PM	P	P	P	P
Calculus	Fa	Fa	Fa	Sl	Ml	Sb	-	-	-	Sl	Hb	-	Sl	Fa	Fa	Fa
DEH	-	-	-	-	-	L	-	-	-	L	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	4	4	7	4	4	3	-	-	-	3	4	-	3	6	5	4

Skeleton Number	**5**															
Preservation	Excellent															
Completeness	97%, all															
Age	26-35, young middle adult															
Sex	Male															
Stature	174.3 ± 3.27 cm															
Non-Metric Traits	Ossicle in lambdoid (bilateral), maxillary torus (bilateral), mandibular torus (left), absent zygomaticofacial foramen (left), Poirier's facet (right), hypotrochanteric fossa (right), double anterior calcaneal facet (bilateral), double inferior talar facet (bilateral)															
Pathology	Schmorl's nodes, sinusitis, periostitis of tibiae and fibulae, fracture of right fibula, osteochondritis dissecans of 1st proximal foot phalanx, bone excavations for costoclavicular ligament															
Dental Health	Calculus on 25/27 teeth, caries 71/27 teeth, DEH 1/27 teeth, moderate wear, considerable periodontitis, 1 tooth bud															
	Right Dentition								Left Dentition							
Present	P	P	P	P	P	-	-	-	-	PM	P	P	P	P	P	P
Calculus	Md	Ha	Ha	Ma	Sa	-	-	-	-	-	Fa	Sb	Sb	-	-	Sd
DEH	-	-	-	-	-	-	-	-	-	-	L	-	-	-	-	-
Caries	-	-	-	-	Mm	-	-	-	-	-	-	-	-	-	-	-
Wear	1	3	4	2	2	-	-	-	-	-	1	2	2	4	3	1
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	Ma	Fa	Ml	Hl	Hl	Ha	Ha	Ha	Ha	Ha	Ha	Fa	Ma	Sl	Sl	Sd
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	2	3	4	2	2	2	2	2	2	2	2	2	2	4	3	1

Skeleton Number	**6**
Preservation	Good
Completeness	92%, all except sternum, manubrium, parts of hands, scapulae, ribs

Age	46+, mature adult
Sex	Male
Stature	170.9 ± 2.99 cm
Non-Metric Traits	Ossicle in lambda, ossicle in lambdoid (bilateral), incomplete foramen ovale (bilateral), bridging of supraorbital notch (bilateral), exostosis in trochanteric fossa (bilateral), absent anterior calcaneal facet (left)
Pathology	Paget's disease, osteoporosis, DJD in spine, shoulders, hips, periostitis of right tibia, right radius, left ulna, button osteoma, enthesopathies for gluteus maximus, triceps, soleus, bone excavations for costoclavicular ligament, pectoralis major
Dental Health	Calculus on 2/20 teeth, caries 1/20 teeth, DEH 6/20 teeth, Infractions 6/20, 4 abscesses, considerable wear, considerable periodontitis

	Right Dentition								Left Dentition							
Present	P	AM	AM	P	AM	P	P	P	P	P	PM	AM	AM	AM	AM	AM
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	5	-	7	5	5	5	5	-	-	-	-	-	-
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	P	P	AM	P	P	P	P	P	P	P	P	P	P	AM	AM	P
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	L	L	L	L	L	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Sm
Wear	7	4	-	4	4	5	6	7	7	3	6	6	6	-	-	4

Skeleton Number	**7**
Preservation	Moderate
Completeness	85%, all except right humerus, left foot, most of right foot, cervical vertebrae, parts of sacrum and ribs
Age	46+, mature adult
Sex	Male
Stature	175.1 ± 2.99 cm
Non-Metric Traits	Ossicle at parietal notch (left), mastoid foramen extrasutural (bilateral), acetabular crease (bilateral), double anterior calcaneal facet (left), double inferior talar facets (left)
Pathology	Schmorl's nodes, *arachnoid granulations*, 6 lumbar vertebrae, DJD in spine, elbow, shoulders, hips, osteoarthritis in right wrist, right hand, left elbow, spine, blunt force skull trauma, 2 rib fractures, periostitis of tibiae and right fibula, enthesopathies for soleus, gluteus maximus, adductor longus, bone excavations for costoclavicular ligament, supraspinatus, subscapularis
Dental Health	calculus on 4/8 teeth, caries on 1/8 teeth, DEH at 1/8 teeth, 2 abscesses, considerable wear, considerable periodontitis

	Right Dentition								Left Dentition							
Present	AM	AM	P	Pu	AM	AM	AM	AM	AM	AM	PM	P	P	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	La	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	8	8	-	-	-	-	-	-	-	8	8	-	-	-
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	P	AM	AM	P	P	P	AM	AM	AM	AM	PM	AM	AM	-	-	AM

Calculus	Sl	-	-	Sb	Sb	Mb	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	8	0	0	6	6	6	-	-	-	-	-	-	-	-	-	-

Skeleton Number	**8**
Preservation	Moderate
Completeness	60%, all but mandible, scapulae, left clavicle, most of hands, right foot, most vertebrae and ribs, much of pelvis
Age	46+ mature adult
Sex	Male
Stature	169.4 ± 2.99 cm
Non-Metric Traits	Ossicle in lambdoid (left), accessory supraorbital foramen (bilateral), acetabular crease (bilateral), Poirier's facet (left), exostosis in trochlea fossa (bilateral), double anterior calcaneal facet (left)
Pathology	*Cribra orbitalia*, periostitis of tibiae, DJD in spine, enthesopathy for gluteus maximus
Dental Health	Calculus on 13/15 teeth, caries on 1/15 teeth, DEH on 6/15 teeth, infractions on 2/15 teeth, 6 abscesses, considerable wear, considerable periodontitis

	Right Dentition								Left Dentition							
Present	P	P	P	P	P	P	P	P	PM	P	P	P	P	P	P	P
Calculus	Fb	Sb	Fb	Fb	-	Mb	-	Sb	-	Mb	Sb	Mb	Mb	Mb	Mb	Mb
DEH	-	-	L	L	L	L	L	L	-	-	-	-	-	-	-	-
Caries	-	Mm	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	6	7	7	6	6	6	4	7	-	7	4	5	6	7	7	6
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

KEY:
Present - Tooth presence; am - ante-mortem tooth loss; pm - post-mortem tooth loss; p - tooth present; - - jaw not present
Caries - Calculus; F - flecks of calculus; S - slight calculus; M - moderate calculus; H - heavy calculus; a - all surfaces; b - buccal surface; d - distal surface; m - mesial surface; l - lingual surface; o - occlusal surface
DEH - dental enamel *hypoplasia*; l - lines; g - grooves; p - pits
Caries - caries; s - small lesions; m - moderate lesions; l - large lesions
Wear - dental wear; numbers from 1-8 - slight to severe wear

Table 1 Disarticulated Bone

Context	**Context Type**	**Bones**	**Age**	**Sex**	**Other**
1022	Demolition layer	1st proximal foot phalanx	Adult	-	All
1032	Burial	Left navicular	Adult	-	All
1215	Destruction layer	Cervical vertebra	Adult	-	All
1314	Cut of a burial	Scapula glenoid, coracoid acromion	Adult	-	Left 20%

		Cervical vertebra	Adult	-	All
		Mandible	Old middle adult	Male?	Right 1st molar, premolars, canine, incisors, left incisors, 2nd and 3rd molars, DEH on 6 anterior teeth, slight calculus, moderate wear